AP Statistics Test
Describing Data
Instructor's Version

Free Response: 2 questions, 52 points, 30 minutes

1. Shown below are the summary statistics for test scores from two different AP Statistics classes — one taught first period and one taught third period.

	Mean	Std. Dev.	n	Median	Q1	Q3	Min.	Max.
First-period test scores	75.7	11.93	20	78.5	72	82.5	48	94
Third-period test scores	81.8	9.6	29	85	74	89	57	96

NOTE: A student saw a paper that showed the two lowest grades for the first-period class, which were 48 and 68.

A. Construct box plots for the two classes on the same horizontal axis with one box plot above the other box plot. Be sure to check for outliers. (10 points)

Answer: The top box plot should be the first-period class, and the bottom box plot should be the third-period class. The horizontal axis should be labeled "test scores" and should be numbered. The outlier of 48 needs to be shown for the first-period class. Whisker goes to 68 with min, max, median, and quartile values drawn in correctly for both classes. (See box plot provided on next page.)

Calculations for outliers should be shown for both classes. Lower outliers are any scores less than Q1 – 1.5(IQR), and upper outliers are any scores above Q3 + 1.5(IQR). The remaining 4 points are awarded for outlier calculations shown as follows:

First-period class: IQR 82.5 – 72 = 10.5
72 – 1.5(10.5) = 56.25, so 48 is a low outlier
82.5 + 1.5(10.5) = 98.25, so no high outliers

Third-period class: IQR 89 – 74 = 15
74 – 1.5(15) = 51.5, so no low outliers
89 + 1.5(15) = 111.5, so no high outliers

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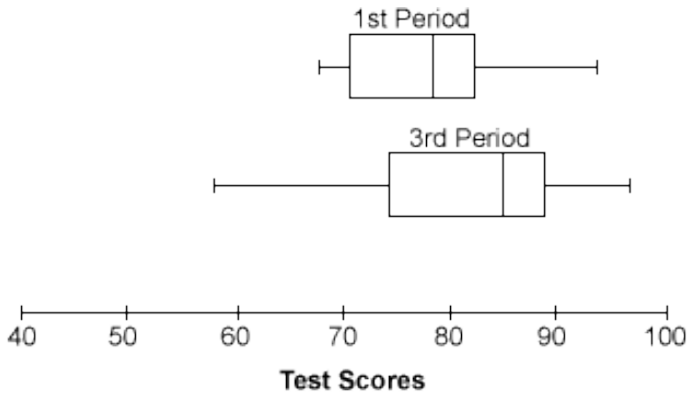
Box Plot:



Scoring:
- 6 points for correct sketch with proper labeling
- 4 points for correct outlier calculations

B. Which class had the better overall performance? Justify your answer. (12 points)

Answer: The student should state that the third-period class had the better performance and must compare a minimum of two of the following: medians, IQR or range, overall shape, and position of the box plots. The median score for the third-period class was 85 compared to 78.5 for the first-period class. The box plot for the first-period class is skewed right, indicating few high scores, while the box plot for the third-period class is skewed left, indicating few low scores. IQR for first period includes scores from 72 to 82.5, compared with scores from 74 to 89 for the third-period class, which also indicates better performance.

Scoring:
- 4 points for indicating that the third-period class performed better
- 8 points (4 points each) for correct comparisons to justify decision

C. The first-period class has a standard deviation of 11.93. Explain how this value summarizes variability in this class. (4 points)

Answer: The standard deviation (s = 11.93) measures a typical or average distance between the individual test scores and the mean test score for the first-period class.

Scoring:
- 4 points for correct interpretation of the standard deviation

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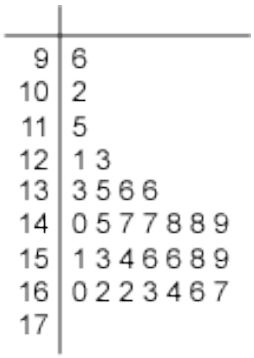
2. The stemplot below shows the weights of 30 male high school students from Small Rock High School.



9	6
10	2
11	5
12	1 3
13	3 5 6 6
14	0 5 7 7 8 8 9
15	1 3 4 6 6 8 9
16	0 2 2 3 4 6 7
17	

Key:

15 | 1 = 151

A. Using your knowledge of statistics, describe the distribution. Include statistics and discussion of shape, center, and spread. (20 points)

Answer: The shape of the distribution is skewed left. The center of the distribution is the median, which is 148.5. Spread can be described as the range from 96 pounds to 167 pounds or by the IQR from 136 pounds to 159 pounds. The weight of 96 pounds is a low outlier.

Scoring:
- 5 points for the shape
- 6 points for measures of central tendency:
  - mean: 145.07;
  - median: 148.5;
  - mode: 136, 148, 156, 162 with discussion such as "left skewed drags mean below the median" and "four modes not significant to measure of central tendency"
- 6 points for spread, characterized by range: 167 – 96 = 71; sample standard deviation: 18, 46; and IQR: 159 – 136 = 23
- 3 points for addressing presence of outliers and showing calculations
  - Low: 136 – 1.5(23) = 101.5, so 96 is a low outlier
  - High: 159 + 1.5(23) = 193.5, so no high outliers

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B. Would it be reasonable to use this information to generalize about the distribution of weights for the entire population of high school boys? Why or why not? (6 points)

Answer: It would not be reasonable for the following reasons: The sample was not random, it was very small, and it included only boys from one high school.

Scoring:
- 6 points (3 points each) for the explanation given. The answer should include at least two of the given explanations.

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